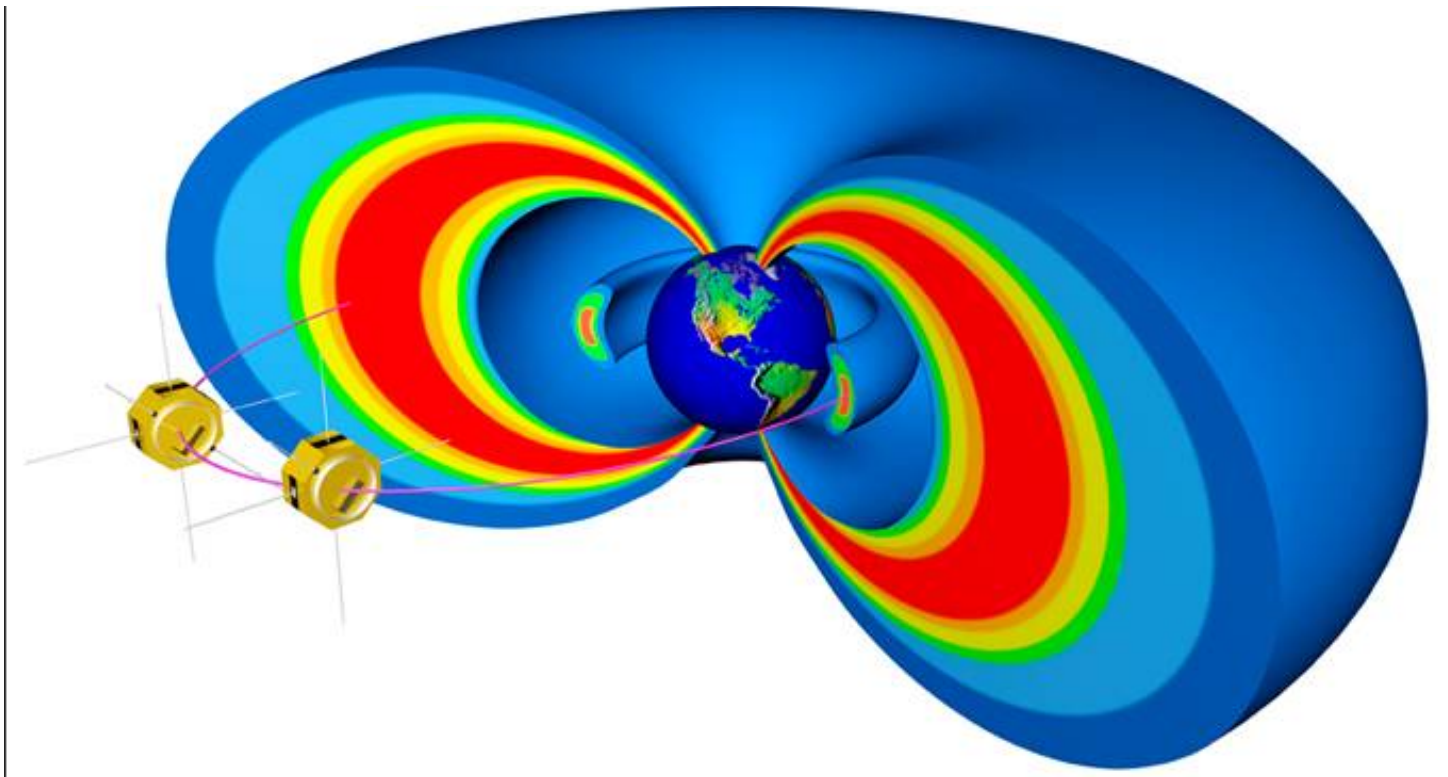


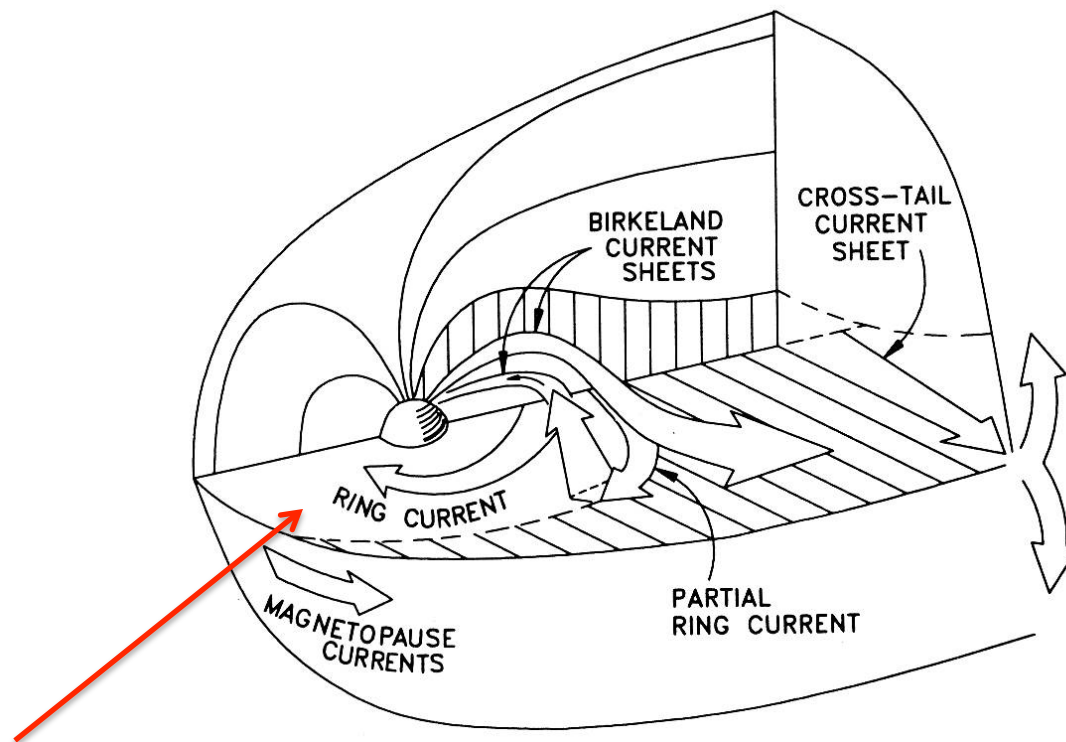
On-Line Visualization

Ring Current / Radiation Belt

Radiation Belts

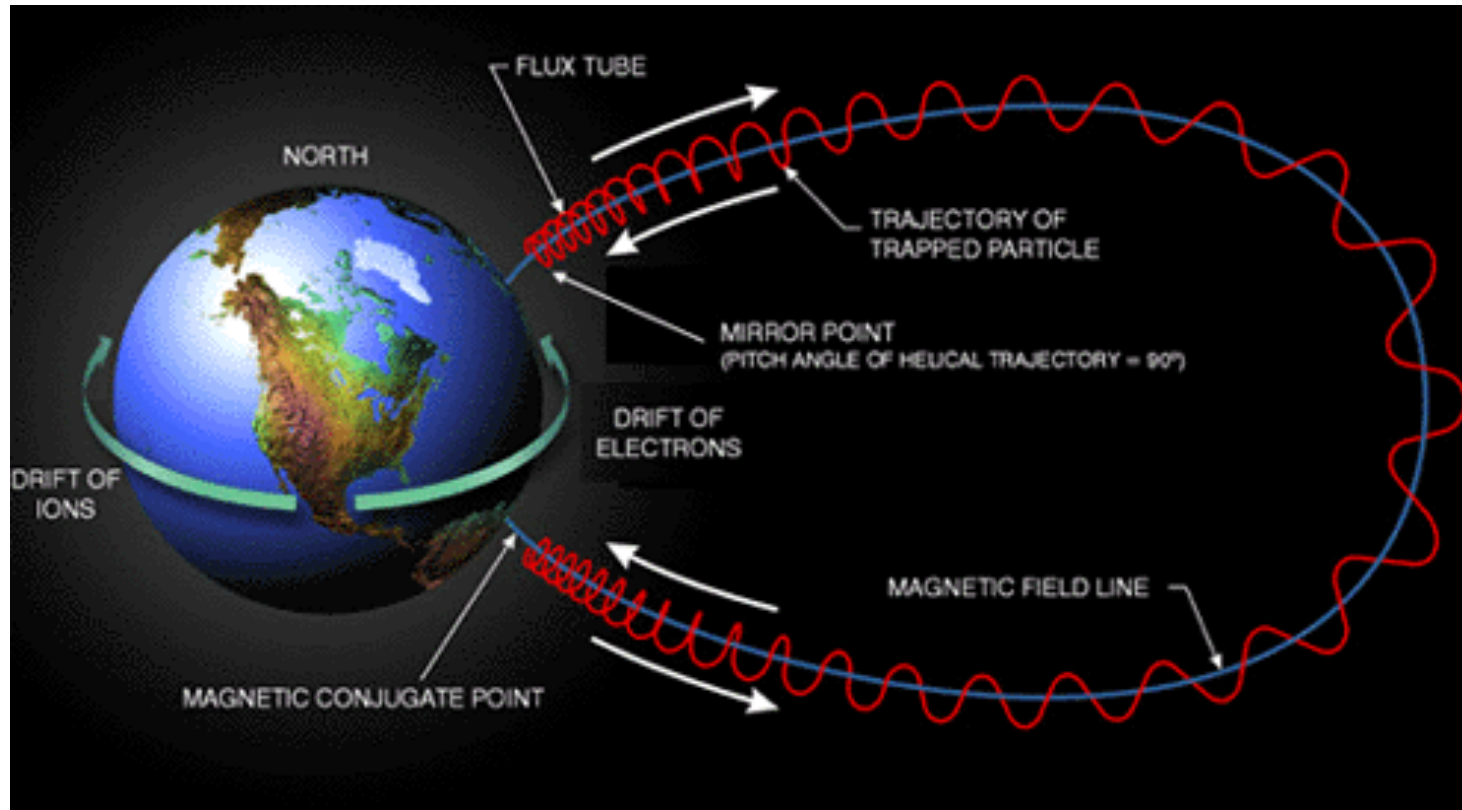


Magnetosphere Current Systems



The **ring current** is one of the major current systems in the Earth's magnetosphere. It circles the Earth in the equatorial plane and is generated by the longitudinal drift of energetic (10 to 200 keV) charged particles trapped on field lines between ~ 2 and 7 Earth's radii.

The charged particles that make up the **ring current** and **radiation belts** are trapped in the Earth's magnetic field, bouncing back and forth along the magnetic field lines between "mirror points" in the northern and southern hemispheres.



Ring current circles the Earth in the equatorial plane and is generated by the longitudinal drift of energetic (10 to 200 keV) charged particles trapped on field lines.

Physical Variable Written by Ring Current and Radiation Belt Simulations

- All variables are **averaged over particle bounce motion** along magnetic field lines between “mirror points”.
- Magnetic field lines are identified by the location of their crossing of the equatorial plane (X, Y).
- Particle Fluxes are presented in spatial coordinates in the equatorial plane at (X, Y), equatorial pitch angle, and 12 **energy levels**.
- Fluxes **F** for electrons (**e⁻**) and hydrogen ions (**H⁺**): identified by the (sine of the) equatorial pitch angle ($F_{PA}=?$???)
- Pitch-angle-integrated fluxes identified by:
 - **_tot**: **Total flux for species** (all pitch angles),
 - **_par**: Fluxes along magnetic field B (Pitch angle <60 deg, "PA" <0.866),
 - **_perp**: Fluxes perpendicular to B (Pitch angle >60 deg, "PA" >0.866),
 - **_anis**: Pitch-angle anisotropy $(F_{perp}-F_{par})/F_{tot}$.

Heliophysics Laboratory Primer

Ring Current Electrons

[Click here](#)

L1 into Geospace (Labs I & II)

Results of magnetosphere, ring current (RC) and radiation belt (RB) simulations with artificial conditions

Magnetosphere Lab v2012

2002/04/19 Event

- Results of magnetosphere simulations driven by ACE data

2010/04/05 Event

- Results of magnetosphere RC and RB simulations driven by ACE data
- iSWA Layout: Space Weather Impact on Geospace

Sun to L1 (Labs III & IV)

On-line Visualization Ring Current Electrons

[Click here](#)

Results of magnetosphere, ring current (RC) and radiation belt (RB) simulations with artificial conditions

Run Number	Key Words	Model	Model Version	Start Time	End Time	Dipole Tilt (in the X-Z Plane) at Start deg	N	V _x	V _y	B	IMF Clock Angle
HSS2011_SWMF_053111_2	HSS2012, Southward IMF	BATSRUS	v8.01	2000/01/01 00:00	2000/01/01 02:00	0.00	5.00000	-400.00000	0.00000	5.00000	180.0
HSS2011_SWMF_053111_4	HSS2012, Northward IMF	BATSRUS	v8.01	2000/01/01 00:00	2000/01/01 02:00	0.00	5.00000	-400.00000	0.00000	5.00000	0.0
HSS2012_SWMF_052212_1	HSS2012, North-South IMF turning	SWMF	v20110131	2000/01/01 00:00	2000/01/01 05:00	0.00	5.00000	-400.00000	0.00000	5.00000	0

On-Line Visualization: Ring Current Electrons

HSS2012_SWMF_052212_1

Title/Introduction:

Key Word: HSS2012, North-South IMF turning

Model Type: GM

Model: SWMF version v20110131

Click here



- View [solar wind input data](#)
- List [solar wind input data](#) in ASCII format (see [format description](#) here).
- View [Magnetosphere](#)
- Create [Timeseries in Magnetosphere](#)
- View [Ionosphere](#)

View pre-computed timeseries data:

- [Northern hemisphere polar cap flux and area](#)
- [Southern hemisphere polar cap flux and area](#)
- [Magnetopause standoff and closest approach within 30 deg. of Sun-Earth line \(local noon\)](#)
- [Polar cap boundary at 24 magnetic local times](#)
- [Ionospheric dissipation](#)
- View [Fok Ring Current Electrons](#)
- View [Fok Ring Current Protons](#)

Make a First Plot with Default Selections

Click here

3D Simulation Results: Model: Fok Ring Current Run: HSS2012_SWMF_052212_1 e-

This is the web interface for the visualization of results of a three-dimensional simulation of Earth's environment.

Please review the **default selections** below and make your changes.

To start the graphics program click the *Update Plot* button. The resulting image will be displayed at this location of the page.

Should the result be a black image, then the graphics program encountered a programming error. Please report the set of input parameters used.

[Go back to web page of run](#)

Update Plot

Update Plot will update (generate) the plot with the chosen time and plot parameters below.

This will take some time (typically 10-30s) as data is read in and processed.

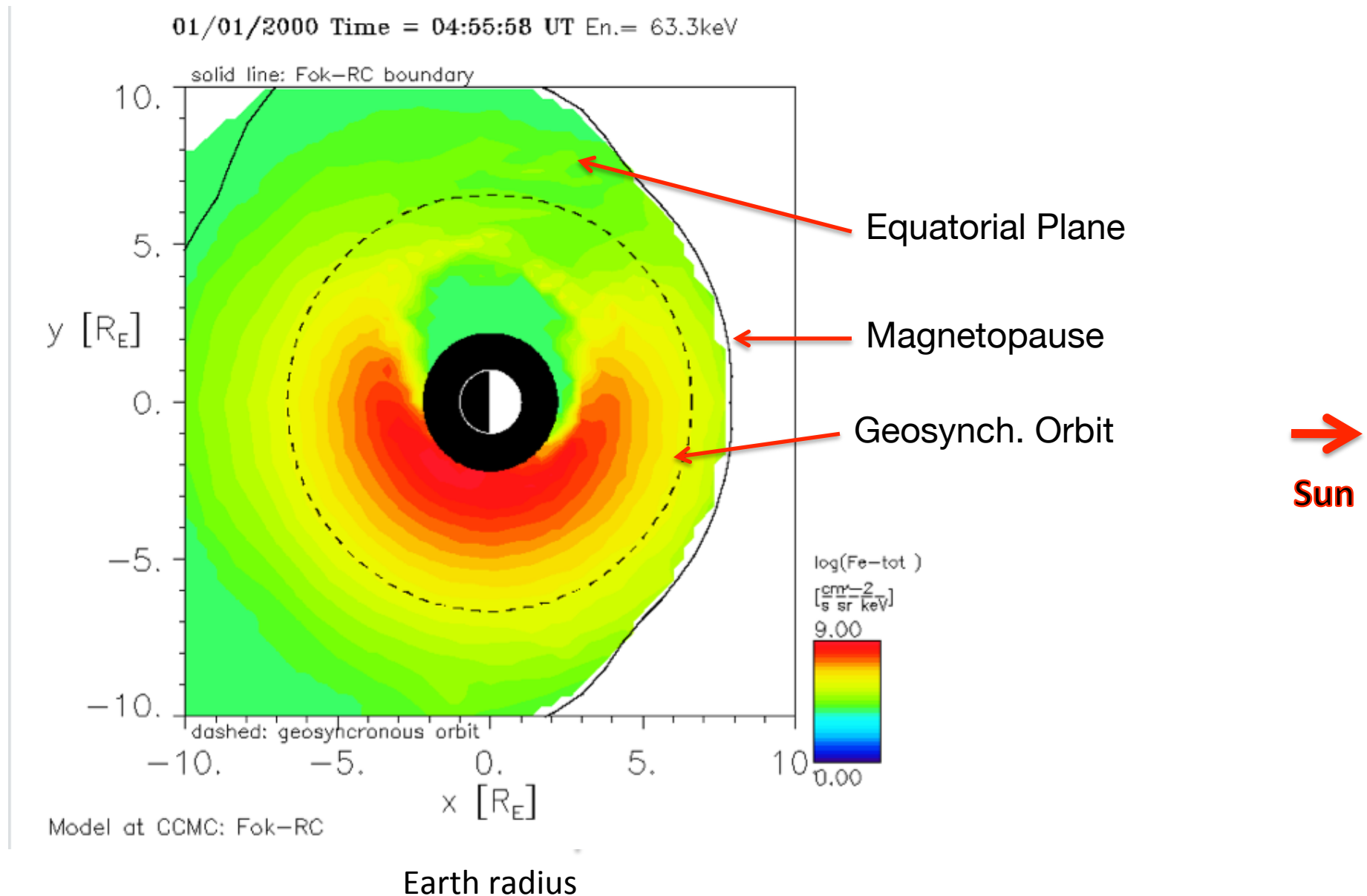
☉ Choose data time:

Date: 2000/01/01 Time: 04:55:58

Choose time step from the pull-down menu

Click “**Update Plot**” to make a plot with default selections

Electron Total Flux. Energy 63.3 keV. Color Contour



Select Energy Level $E_n = 22.45$ keV

Choose Plot Area:

All **Plot Modes** except **Line Plot** and **Vertical Plot**: Select lower left corner of plot area on the left, and the upper right corner on the right.

Line Plot: Select start point of line on the left, the end point on the right.

Vertical Plot: Select X and Y position on the left.

X₁ X₂ Range: -10 ... 10 R_E

Y₁ Y₂ Range: -10 ... 10 R_E

☐ Use (r,MLT) instead of (X, Y):

r₁ r₂ Range: 2.2 ... 13 R_E

MLT₁ MLT₂ Range: 0 ... 24 hours

Choose Cut Plane:

X=constant ☐

Y=constant ☐

Energy=constant ☒

1.00000
1.67900
2.82100
4.73800
7.95700
13.3650
22.4470
37.7010
63.32
106.350
178.620
300.000

☐ use log(Energy) to plot

Energy₁ Energy₂ Range: 1 ... 300 keV

Reset Form will reset changes to the defaults specified by the previous script.

Update Plot will update (generate) the plot with the chosen time and parameters above.

☐ **List Data** (check to get any of the following outputs which apply to movie request):

What: ☒ Plot variables from above

☐ Include all primary model output parameters (**Warning:** text files may be large).

You have to select **vector magnitudes** (e.g., "B", "V", "J") explicitly for plotting them:

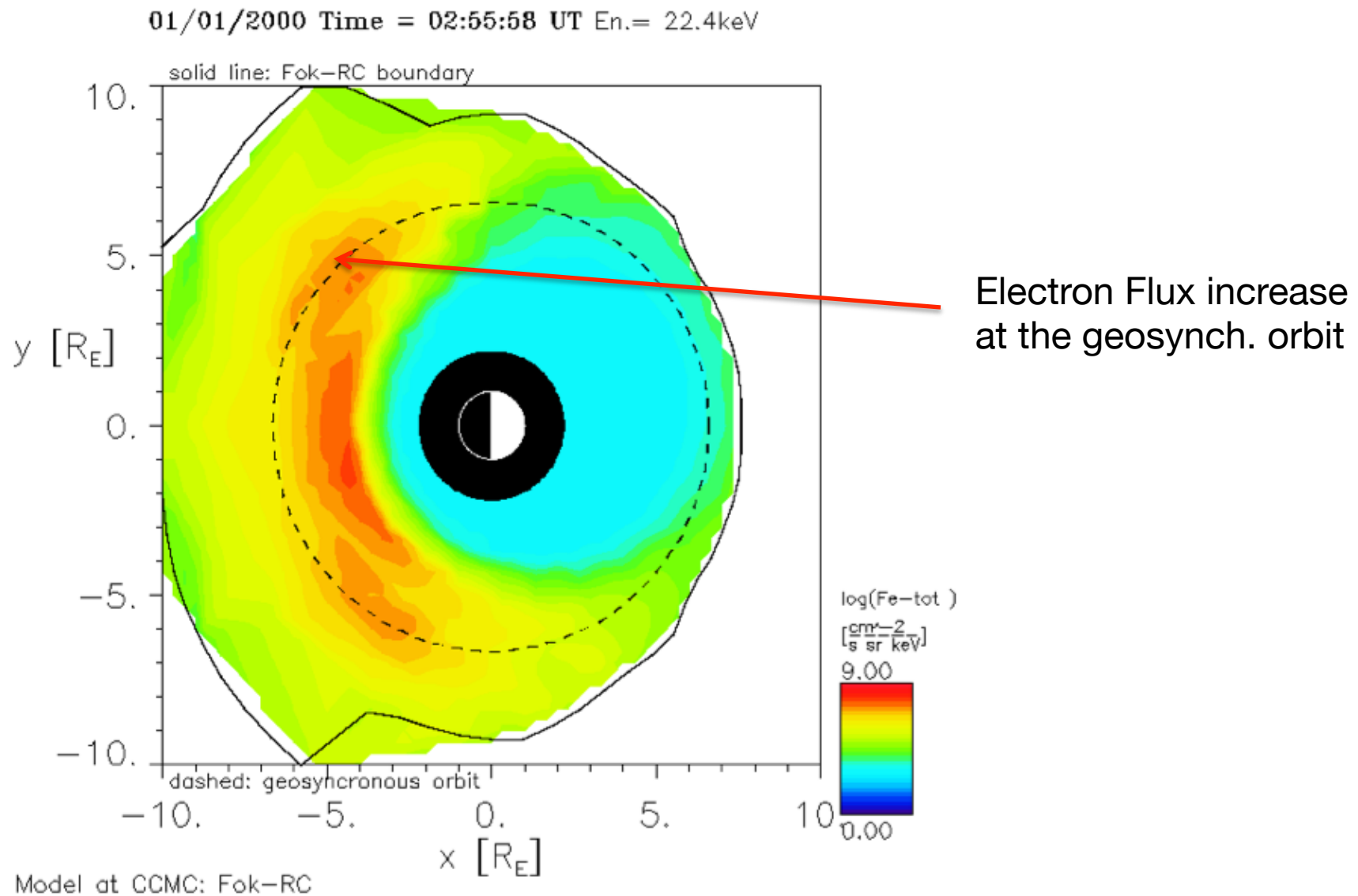
computed scalars such as

Click **“Update Plot”**

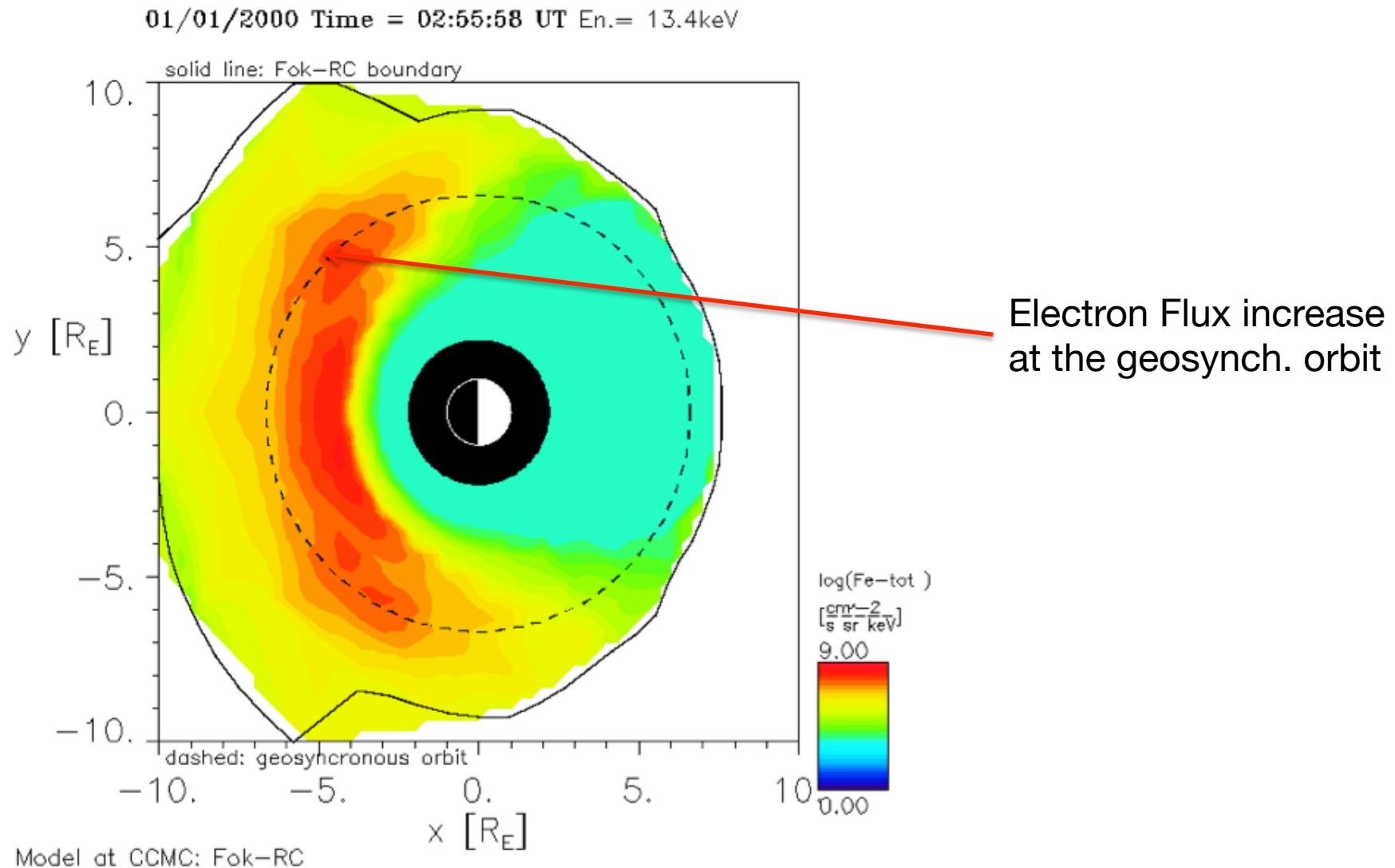
Choose $E_n=22.45$ keV
from the
Energy=constant
pull-down menu

Select time 2:56

Electron Total Flux. Energy 22.45 keV. Color Contour



Electron Total Flux. Energy 13.4 keV. Color Contour



Space Weather Effect of Ring Current Electrons: Surface Charging

Electrons with energies in the range of several to several tens of keV are responsible for surface charging of spacecrafts in geosynchronous orbit.

The differential charging of spacecraft surfaces can give rise to destructive arc discharges, causing satellite operational anomalies.

Intense fluxes of these electrons can be caused by north-south IMF turning and substorms.

Surface charging occurs more often in the midnight to dawn sector.

Electron Fluxes in Energy Range 5 – 50 keV at the Night Side (Magnetic Local Time MLT = 0)

Choose Plot Area:

All **Plot Modes** except **Line Plot** and **Vertical Plot**: Select lower left corner of plot area on the left, and the upper right corner on the right.

Line Plot: Select start point of line on the left, the end point on the right.

Vertical Plot: Select X and Y position on the left.

X₁ X₂ Range: -10 ... 10 RE

Y₁ Y₂ Range: -10 ... 10 RE

Choose Cut Plane:

X=constant ☐

Y=constant ☐

☒ Use (r,MLT) instead of (X, Y):

r₁ r₂ Range: 2.2 ... 13 RE

r=constant ☐

MLT₁ MLT₂ Range: 0 ... 24 hours

MLT=constant ☒



☐ use log(Energy) to plot

Energy₁ Energy₂ Range: 1 ... 300 keV

Energy=constant ☐

Reset Form will reset changes to the defaults specified by the previous run of this script.

Update Plot will update (generate) the plot with the chosen time and plot parameters above.

Select MLT=constant
instead of
Energy=constant

Set MLT=0 (midnight)

Set Energy range
between 5 and 50 keV
Select time 2:56

Click **“Update Plot”**

Electron Fluxes in Energy Range 5 – 50 keV at the Night Side (Magnetic Local Time MLT = 0)

